Prediction of Dry Matter Intake Based on Ruminal Degradation from Milking Cows Grazing Coast-Cross Grass

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PREDICTION OF DRY MATTER INTAKE BASED ON RUMINAL DEGRADATION FROM MILKING COWS GRAZING COAST-CROSS GRASS[1]

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Abstract

Dry matter intake (DMI) of coast-cross grazing by crossbred Holstein-Zebu and Zebu lactating cows was calculated using in vitro dry matter digestibility from extrusa (four esophageal fistulated cows) and fecal output estimate with mordent chromium. Pasture was rotationally grazed with three days grazing period and 27 days resting period, adopting a stocking rate of 1.6 and 3.2 cows/ha, during the dry and rainy season respectively. Voluntary DMI was estimated from degradation characteristics using different equations. Predicted coast-cross DMI varied with models. The prediction of tropical forages dry matter intake from equations based in ruminal degradation parameters needs further investigation before being employed in practice.

Keywords: degradability, dry matter intake, grazing, lactating cows, prediction equations

Introduction

Due to the difficulty in making direct determinations of DMI of grazing animals a number of indirect methods have been evolved. always considering digestibility of dry matter intake and fecal output. Indirectly. fecal output can be determined based on the ratio between the quantity of a marker dosed to an animal and its concentration in the feces. In contrast to daily dosing a marker (mordent chromium) may be administered once to an animal followed by frequent fecal collections in order to characterize the "pulse" in marker concentration found in the feces (Pond et al. 1989).

The *in situ* bag technique was evaluated as a method of predicting the voluntary intake and digestibility of forage by several authors Von Keyserlingh & Mathinson (1989).

The goal of this trial was compare the dry matter intake of coast-cross grazed by crossbred and zebu lactating cows. estimated with the model suggested by Pond et al. (1989) and different equations predicting the dry matter intake as proposed by Von Keyserlingk & Mathinson (1989); ∅rskov et al. (1988); Shem et al. (1995) and Madsen et al. (1997).

Material and Methods

The trial was carried out at Experimental Station of Ribeirão Preto, São Paulo, State Brazil. The evaluations were done twice from June to November 1996 and twice from January to April. 1997. Lactating crossbred (8) and zebu (8) multiparous cows between 30 and 90 days in milk. with an average body live weight of 490 and 422 kg respectively were used. The experimental design adopted was a randomized blocks with two treatments (crossbred and zebu cows) eight repetitions and four times.

During the experimental period cows grazed coast-cross (*Cynodon dactylon* (L) Pers). pasture managed in a rotational system with three days grazing and 27-days resting period. Stocking rate was 1.6 cows/ha from June to November and 3.2 cows /ha from January to

April. All the cows were supplemented with 3 kg of concentrate and received mineral salts *ad libtum*.

For the DMI estimations were adopted the indirect method using the *in vitro* dry matter digestibility (IVDMD) from extrusa collected from four esophageal canulated cows (two crossbred and two zebu cows) and the fecal output calculated by the administration of a pulse dose of neutral detergent fiber (NDF) of the extrusa marked with mordent chromium (Colucci et al.. 1984) as described by Pond et al. (1989).

The fecal collection was done by grab samples during six days after the pulse dose of mordent chromium. The chromium was analyzed by spectrophotometry following the Willians et al. (1962) recommendations. The fecal output was calculated using the excretion curves proposed by the one compartment model time dependent described by POND et al. (1989). This model allows the estimation of fecal output rumen and pos-rumen rate of passage. and dry matter intake.

The *in situ* degradability was performed at the end of each collection time. using three non-lactating crossbred cows. adapted to the coast-cross pasture. receiving the same concentrate in the same amount of the tested cows. The nylon bags were incubated with 5 g of owen dry material. originated from extrusa. at different times (3. 6. 12. 24. 48. 72. 96 h). The DMI predictions were calculated by the degradations parameter (Mehrez & Ørskov, 1977). where “a” is the soluble material. “b” the potential degradable material and “c” the rate of degradation of “b”. The equations tested were proposed by Von Keyserlingk & Mathinson (1989). where: DMI = -1.19 + 0.035 (a+b) + 28.5c. Ørskov et al. (1988). where: DMI = -0.822 + 0.0748 (a+b) + 40.7c. SHEM et al. (1995). where: DMI = -8.286 + 0.266a + 0.102b +17.696c and Madsen et al. (1997).

Madsen et al. (1997) developed a method where the rate degradation in the rumen is combined with the rate of the outflow to give an estimate of the fill of the feeds. The potential

intake of the feeds is described by their physical fill with the unit day. The capacity of an animal to eat the feed has the unit kg. The intake is then predicted by dividing the capacity of the animal with the fill of the feeds giving the unit kg/day $^{-1}$. Them fill is calculated by the formula: FILL = [(1-a-b) / k + (c + k)]/24 being "k" the fractional rate of passage (h^{-1}). The potential daily NDF intake of feedstuff ascribed to a limitation of the physical capacity of the reticulo-rumen can then be calculated as: FI_{NDF} (kg/day $^{-1}$) = Rumen capacity (kg NDF) / fill (days) and the potential dry matter (DM) intake (FI_{DM}) of a feedstuff can then be calculated as: (FI_{DM}) = 1 / Proportion of NDF in the feedsuff DM x FI_{NDF}. For the NDF intake was considered the rumen capacity as 1.2 % of the cows live body weight as proposed by Mertens (1987).

The differences among the average DMI estimated with mordent chromium and the different equations were analyzed using Tukey test 5%. Utilizing ANOVA program from SAS. 1990.

Results and Discussion

The results obtained with the *in situ* incubation are shown in Table 1. No difference (P>.05) was found among any variable estimated. in relation to the time of the sample collection. The data of effective DM degradability (DE) calculated from the formula proposed by Orskov & McDonald (1979) varied from 40.2 to 48.3. respectively. in November. 1996 and April. 1997. These values were similar to the (45.5%). reported by Aroeira et al. (1996). and higher than (33.3%) that observed by Berchielli et al. (1996). working with coast-cross hay.

The mean total DMI. considering the concentrate fed (3.0kg /cow/day). was 6.7 kg/cow/day or 1.5 % of live body weigh (BW) and DMI originated from the coast-cross grass. both estimated with the model described by Pond et al. (1989) were 4.7 kg/cow/day or 1% of BW for crossbred cows. with a milk production of 10.6 kg/kg/day and 2.7 kg/cow/day or .7%

of BW for zebu cows with a milk production of 6.4 kg/cow/day. Those data resulted from the pasture DMI were lower than that (2.5% BW) reported by Marrero et al. (1989) working heifers and much lower than 8.5 kg/cow/day as described by Milena et al (1987) with cows producing 10 kg of milk per day without any concentrate supplementation.

The data obtained from the equations of prediction are shown in table 2. All the DMI predictions from coast-cross grass overestimated the pasture intake. However. it should be mentioned. that those equations were based on the potential of the rumen degradation of the forage and did not considered any influence of the substitution rate caused by the ingestion of the concentrate. The DMI estimated as calculated by Orskov et al (1988) was 5.5 kg was the lowest one ($P<.05$) followed by the 7.7 kg as suggested by Madsen et al. (1997) and the similar values of 12.2 and 12.7 kg/cow/day as proposed by Von Keyserlingk & Mathison (1989) and Shem et al. (1995) respectively.

The prediction of dry matter intake from cows grazed tropical grass need to be more studied in longer trials with a large number of animals. preferentially maintained in an exclusively grazing system.

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Table 1 - Degradability parameters of DM: “a” soluble dry matter, “b” potential degradable dry matter, “c” rate of degradation from “b”, “k” ruminal rate of passage and effective degradability “DE”.

	DM degradability parameter				
Month	a (%)	b (%)	c (% /h)	K (%/h)	DE (%)
June	75.5	63.5	2.17	1.8	47.3
November	62.8	52.4	1.78	1.5	40.2
January	56.4	62.6	3.97	2.1	41.1
April	61.9	43.1	3.63	1.4	48.3

Table 2 - Mean DMI from cost-cross estimated by the model of Pond and predicted by different equations as kg/cow/day and as percentage of live body weight (% of BW)

MODEL	kg/day	% of BW
Madsen	7.76 b	1.70 b
Von Keyserlingk	12.18 a	2.66 a
Shem	12.74 a	2.79 a
Orskov	5.49 c	1.19 c
Pond	3.69 d	0.80 d
CV (%)	13.07	9.18

Data followed by different letters in the column are different (P<.05) by Tukey test.